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PROCEEDINGS.

Eight hundred and thirteenth Meeting.

May 29, 1888. — ANNUAL MEETING.

The PRESIDENT in the chair.

In the absence of the Recording Secretary, Mr. Henry W. Haynes was appointed Recording Secretary *pro tempore.*

The report of the Council was read by the Corresponding Secretary.

The Treasurer's report was read by Mr. Augustus Lowell, accepted, and placed on file.

The Librarian's report was read by Mr. Henry W. Haynes, accepted, and placed on file.

The report of the Rumford Committee was read by the President as follows.

The Rumford Committee present the following report for the year ending May 29, 1888: —

An appropriation of $250 was recommended by the Committee, and voted by the Academy, to assist Professor Trowbridge in his investigations on metallic spectra. The committee have approved of bills amounting to $219.72 for printing in the Memoirs or Proceedings of the Academy papers on the subjects of Light or Heat.

After mature deliberation, the Committee have voted unanimously to recommend to the Academy the award of the Rumford Medals to Professor Albert A. Michelson for his determination of the velocity of light, for his researches upon the motion of the luminiferous ether, and for his work on the absolute determination of the wave-lengths of light; and the annexed vote is offered for the consummation of this award.

For the Committee,

JOSEPH LOVERING, *Chairman.*

The report was accepted, and it was

Voted, That the Rumford Premium be awarded to Professor Albert A. Michelson, as recommended by the Rumford Committee, and that the Treasurer be authorized to pay from the income of the Rumford Fund the amount required for the preparation of the Rumford Medals.

On the motion of the Corresponding Secretary it was

Voted, To meet on adjournment on the second Wednesday in June.

On the motion of Professor Jackson, it was

Voted, To amend No. 9 of the standing votes by changing the hour for the Annual Meeting from half-past three o'clock, P. M., to half-past seven o'clock, P. M.

Dr. William Everett read a biographical notice of the late Hugh A. J. Munro.

Professor Arthur Searle read a notice of the late Alvan Clark.

The annual election resulted in the choice of the following officers: —

JOSEPH LOVERING, *President.*
ANDREW P. PEABODY, *Vice-President.*
JOSIAH P. COOKE, *Corresponding Secretary.*
WILLIAM WATSON, *Recording Secretary.*
ELIOT C. CLARKE, *Treasurer.*
HENRY W. HAYNES, *Librarian.*

Council.

C. LORING JACKSON,
CHARLES R. CROSS,
AMOS E. DOLBEAR,
} of Class I.

HENRY W. WILLIAMS,
WILLIAM G. FARLOW, } of Class II.
ALEXANDER AGASSIZ,

JOHN C. ROPES,
FREDERICK W. PUTNAM, } of Class III.
WILLIAM EVERETT,

Rumford Committee.

WOLCOTT GIBBS, JOSIAH P. COOKE,
EDWARD C. PICKERING, JOSEPH LOVERING,
JOHN TROWBRIDGE, GEORGE B. CLARK,
ERASMUS D. LEAVITT.

Member of the Committee of Finance.

THOMAS T. BOUVÉ.

The President appointed the following standing committees: —

Committee of Publication.

JOSIAH P. COOKE, ALEXANDER AGASSIZ,
JOHN C. ROPES.

Committee on the Library.

HENRY P. BOWDITCH, AMOS E. DOLBEAR,
EDWARD J. LOWELL.

Auditing Committee.

HENRY G. DENNY, THOMAS T. BOUVÉ.

The President reported that he had requested Mr. W. W. Story, of Rome, Associate Fellow, to represent the Academy at the celebration of the eighth hundredth anniversary of the University of Bologna, and this action was ratified by the Academy.

Eight hundred and fourteenth Meeting.

June 13, 1888. — ADJOURNED ANNUAL MEETING.

The PRESIDENT in the chair.

The President announced the deaths of Charles S. Bradley and John Dean, Resident Fellows; of Spencer F. Baird, Associate Fellow; and of Matthew Arnold, Foreign Honorary Member.

The meeting was devoted to a commemoration of the late Asa Gray. The President opened the proccedings in the following words: —

The death of Dr. ASA GRAY has already been announced to the Academy in the usual simple manner, and the Council has discharged its duty in providing for an appropriate notice of his life and scientific work. Before calling for the reading of this paper, I desire to say a few words, and present some resolutions.

Nowhere else, except in his home, will Dr. Gray be so much missed as in this hall, and from these meetings. He was elected into the Academy on November 10, 1841, — a year before he took up his residence in Cambridge as Professor of Natural History in Harvard University. From the first, he was devoted to the scientific interests of the Academy, and active in its administration.

He was the Corresponding Secretary for seventeen years, viz. from 1844 to 1850, and again from 1852 to 1863. He was highly qualified for this office, as he had a large personal acquaintance with the scientific men of Europe. He was Chairman of the Committee of Publication for four years, viz. from 1846 to 1850, and in this capacity inaugurated the publication of the Proceedings of the Academy in octavo form, to supplement the ponderous volumes of Memoirs. He was President for ten years, viz. from 1863 to 1873. As Corresponding Secretary and President, he was an *ex officio* member of the Council, and for six years at other times, by election, — in all for seventeen years. But all these official duties are only the means to an end: this end is the advancement and diffusion of science. The richness of Dr. Gray's contribution to the Memoirs and Proceedings of the Academy admits of no comparison; though it was only the overflow from his abundant learning, which was circulating at the same time in numerous other channels.

In view of Dr. Gray's many and varied services to the Academy, of his devotion to his chosen science, his exalted character, and his inspiring example, I propose to the Academy to put on record the following resolutions: —

Resolved, That, as Fellows of the Academy, we are deeply sensible of the loss it has suffered by the death of one who has been associated with it for forty-seven years, who has served it zealously in many relations, and who has done much to maintain its usefulness and the honor of its name at home, and to make it respected throughout the world of science.

Resolved, That, as members of the community, we realize that it also sustains a bereavement in the death of our lamented associate which is not fully measured by his scientific work and reputation, great as these were. By his unselfish devotion to his favorite studies, by his wide sympathies, which condescended to the youngest and least knowing lover of nature, by his joyous spirit and his simple Christian life, he has shown that complete devotion to science can be reconciled with the highest interests of humanity.

Resolved, That a copy of these resolutions be sent to Mrs. Gray, his helpful companion in his life's work, with the respectful sympathies of the Fellows of the Academy.

The resolutions offered by the President were seconded by Mr. Augustus Lowell.

Mr. President, — I have been asked to second the resolutions presented, and to offer a few thoughts suggested by the affectionate reverence with which we dwell upon the memory of our dear friend, Dr. Gray.

In recalling him, we naturally think first of the affection he inspired. We remember the charming smile, the ready grasp, the strong expressions of interest, with which he greeted us. We remember his readiness to help, his patience, his sympathy. None ever sought his aid without being impressed, first, by the certainty of his knowledge, and then by the great kindness with which he gave it. The affection of all who have ever benefited by his teaching is the highest tribute that can be paid to that side of his character.

Dr. Gray was a man of singular simplicity. That consciousness of power he had which is essential to high achievement, but so easily and almost from the start did he assume the place that he was to fill in science, that he bore about him none of the signs of conflict, but held it as a birthright. Ranking with the highest botanists of the age, he did more than perhaps any American to raise the appreciation of our scholarship abroad, while the same simple, lovable qualities which endeared him to us charmed and fascinated his co-laborers there.

But perhaps the most remarkable trait in Dr. Gray was the steadfastness of his religious convictions under a strain to which so many other minds succumbed. Early captivated with the theory of Darwin, which ended by making its author an Agnostic, and has driven into the ranks of unbelief nearly every one of its most earnest disciples, Dr. Gray preserved his religious faith, and strove to reconcile the truths of nature to what he knew to be the truth of God. Unlike Darwin, he could not be dazzled by his own processes of thought, nor could he suffer the ingenuity of any human theory to undermine his convictions of fundamental truth. We all know with what earnestness he argued to reconcile the two, and even those of us who cannot quite follow him in both directions bear witness to the nobleness of his aim, and to the essential service he performed for each.

Others better qualified than I will speak of his professional triumphs. Mine is a simple tribute to the character of one whom I honored, reverenced, and loved.

I ask leave, Mr. President, to second the resolutions you have offered.

After Mr. Lowell, President Eliot of Harvard University addressed the Academy.

The life of Asa Gray always seemed to me a singularly happy one. His disposition was eminently cheerful, and his circumstances and occupations gave fortunate play to his natural disposition and capacity for enjoyment. From opening manhood he studied with keenest interest in a department of natural history which abounds in beauty, fragrance, and exquisite adaptation of means to ends, and opens inexhaustible opportunities for original observing, experimenting, and philosophizing. For sixty years he enjoyed to the full this elevating and rewarding pursuit. These years fell at a most fortunate period; for the continent was just being thoroughly explored, and its botanical treasures brought to light. Dr. Gray's labors therefore cover the principal period of discovery and of accurate classification in American botany. Merely to have one's intellectual life-work make part of a structure so fair and lasting, is in itself a substantial happiness.

His pursuit was one which took him out of doors, and made him intimate with Nature in all her moods. It required him to travel often, and so enabled him to see with delight different lands, skies, and peoples; it gave him intellectual contact with many scholars of various nationalities, whose pursuits were akin to his own. Intellectual sympathy and co-operation led to strong friendships founded securely upon common tastes and mutual services. All these are elements of happiness, — love of nature, acquaintance with the wide earth, congenial intercourse with superior minds, and abiding friendships.

Although Dr. Gray had no children, his domestic experience was one of rare felicity. His life illustrated a remark of his friend Darwin, that with natural history and the domestic affections a man can be perfectly happy. His way of living was that most agreeable to a philosopher; for it was independent, comfortable, and free alike from the restrictions of poverty and the incumbrances of luxury. With simplicity and regularity of life went health and a remarkable capacity for labor.

All appropriate honors came in due course to Dr. Gray from academies, scientific associations, and universities, at home and abroad. The stream began to flow as early as 1844, and continued to the end of his life. With these honors came the respect and affection of hundreds of persons who were devoted to the pursuit in which he was a leader. His reputation was larger than that of a specialist; he was recognized as a clear thinker on philosophical and religious themes, a just and sagacious critic, and a skilful and vigorous writer. It is the greatest of human rewards to be thus enfolded, as years advance, in an atmosphere of honor, gratitude, and love.

Finally, Dr. Gray enjoyed the conscious satisfaction of having rendered during his long and industrious life a great and lasting service to his kind. For many years past he could not but know that he had made the largest and most durable contribution to American botanical science which had ever been made, and that he had done more than any other man to diffuse among his countrymen a knowledge of botany and a love for it. He knew, moreover, that by his own work, and by the interest which his labors inspired in others, he had placed on a firm foundation the botanical department of the University which he served for forty-six years, and that the collections he had created there would have for generations a great historical importance. To have rendered such services was solid foundation indeed for heartfelt content.

Professor G. L. Goodale, the successor of Dr. Gray as Fisher Professor of Natural History in Harvard University, next spoke.

Mr. President, — You have touchingly and truly said that this was one of the scientific homes of him whom we commemorate. Here, almost as distinctly as in the Herbarium which he founded, and which was the principal seat of his ceaseless activities, we can feel his presence. Under the influence of that presence, those who knew the simplicity and modesty of Asa Gray, as the members of this Academy were permitted to know him, realize how completely out of place and taste would be any formal eulogium. Therefore these tributes of affection which are brought to-night do not partake of the nature of formal eulogies; they are merely the presentation of certain phases of what has been so often called a beautiful, fruitful, and well-rounded life.

Not long since, it fell to my lot, as an officer of another scientific organization, to present a sketch of some of the leading events in Dr. Gray's career. During the preparation of the outlines, two things kept pressing themselves constantly upon my attention: first, the singleness of purpose with which Professor Gray devoted himself to the establishment of an Herbarium for the elucidation of the North American Flora; secondly, the zeal with which he engaged in the consideration of every question touching the educational interests of Botany.

This evening you are to hear from one of his successors a biographical notice, in which these two features must be presented as parts of the whole; from another successor, to whom has been wisely intrusted the care of the Herbarium and the completion of the monumental work, you will learn of the devotedness and self-sacrifice by which Professor Gray placed his collection among herbaria of the very first rank. There would therefore appear to be occasion for a special, though very brief, consideration of the second point, namely, some of the relations of Professor Gray to botanical education. On this subject, the Corresponding Secretary has invited me to speak.

Concerning Dr. Gray as a college instructor, I am permitted to quote a few words from a letter by a leading jurist. He says: —

> "I was in college when Dr. Gray was appointed to his professorship at Harvard, and was, I think, the first, or one of the first, to whom he lectured. I remember his lectures well, they were so full of knowledge and of enthusiasm, and so calculated to impress the young mind. I suppose he had not lectured much of late years, and in his many other successes his powers as a lecturer may have been overlooked by those who have written of him."

Even early in his connection with the College, Dr. Gray was accustomed to open his library and herbarium to those who expressed any inclination to carry their botanical studies farther than the very narrow limits of the prescribed course. This generosity was accepted by many, and most highly appreciated by them. It may be said that Dr. Gray always maintained a deep interest in those who had availed themselves of these special opportunities.

It was, however, by his educational works that Dr. Gray was able to exert a wider influence on botanical education than if he had confined himself to the formal college instruction. The works of his educational series are of three grades: 1st, for very young children; 2d, for our grammar schools; 3d, for high schools and colleges. All of these treatises are characterized by the perspicuous style with which you are all familiar in his general writings. The style is never involved: it is essentially French in its clearness. This is as true of his first work, published when he was barely twenty-six, as of his last.

Careful examination of all these many works shows that Dr. Gray's constant endeavor was to lead the student to examine the plant, and not the book, and thus to become self-reliant.

It is worthy of note, that in his books prepared for children Dr. Gray never writes *down* to them; there is no air of condescension. The subject is developed under his charmed hand as naturally as foliage and flowers unfold from buds. The same may be said of his books for the higher grades. There is never any straining after a certain pedagogic effect. Hence his works have an attraction even for those who have little or no interest in Botany itself. Even Mr. Ruskin, in that pleasing, and yet withal provoking, sketch entitled "Proserpina," has a kind word to say for Asa Gray's Text-Book.

One of the most remarkable things connected with Dr. Gray's series is the fact that his Text-Book, now in its plan expanded into a four-volume work, is laid down on substantially the same lines as his earliest treatise, the "Elements." His earliest work is on the whole, however, rather more dogmatic than the last.

Perhaps no single subject treated of in these earliest and latest works is of greater general interest than his presentation of the doctrine of species. One realizes, as he compares the first book with the last, how difficult it must have been to detect relationship, when one felt at heart that there was no more real relationship between different species than exists between the different sorts of trinkets in a toy-shop; those of the same kind being reckoned of one kind because of their shapes, size, substance, and the fact that they have been perhaps turned out by the same machine. In his last treatise, relationship among plants is recognized as true kinship; allied plants are of common blood. And yet the transition from one view to the other is made so naturally, that no shock is felt at the profound change in statement.

Although Dr. Gray welcomed new methods of botanical instruction, there was one which never met his approval; namely, that which attempts to introduce the student first to the lowest and microscopic organisms, and passes thence to the higher plants. He held it to be wrong in theory and vicious in practice to lead a student from the unseen to the seen, — to investigate the unknown before taking up the known. He naturally preferred to have examinations of flowering plants precede a study of microscopic forms. It is of interest to observe that the writers against whom some of his strictures were directed have seen fit in a recent treatise to reverse their earlier sequence.

Professor Gray manifested a sincere interest in public and private schools, especially those designed to prepare boys for college. He watched with attention the attempt to introduce elementary botany as one of the requirements for admission to our College, and he was one of the first to realize that, under existing conditions, the requisition was likely to do more harm than good to botanical education.

In 1872, after almost thirty years of college service, he relinquished it to other hands. But he by no means gave up his care over the department. He remained to the last its judicious counsellor, patiently answering questions and aiding in every way the happy solution of difficult problems of policy. Mr. President, I dare not trust myself to dwell upon this phase of the subject which has been assigned me. The memories of those hours of conference in which the learned teacher gave advice to his younger colleague are yet too fresh to permit of any other than the most general allusion. To the affection which every member of this Academy felt for him was added, in the case of his colleagues, associated in the work of teaching, and brought into daily contact with him, a feeling almost of reverence for a patience which never overstepped its bounds. Hence you will pardon me if reference is made only to the general subjects which appeared to command his interest in the curriculum of his University.

Professor Gray viewed with pleasure the enlargement of facilities for laboratory instruction in Botany. Twice in the fifteen years after he laid down the charge of the department, he had the gratification of seeing the natural development of his well-matured plans demand larger and larger rooms for work. He watched with keen interest attempts to secure accommodations for the accumulating illustrations of Economic

Botany, — collections which he had done everything to divert into the channels marked out by himself. He was particularly attracted to the important adjunct for instruction and research, and for popular education, the Arnold Arboretum. He devised plan after plan to bring back into the course of medical study its traditions of Botany, and he was never wholly reconciled to give this science up to the schools of Pharmacy. He urged his colleagues to overcome their prejudice against having at least one large general elective in Botany, which might serve as a possible attraction to those intending to study the profession of medicine, and he was fond of noting the success attending a smaller elective termed Biology, specially designed for them. Believing that the study of Botany might be made of great use as a discipline in a far different field, he suggested establishing at the Bussey Institution an exceedingly general elective, open to college students, under the title of "Rural Affairs." This elective, comprising a modicum of Botany, was to be arranged for the increasing number of those on whom sooner or later might devolve the care of estates. In short, every phase of botanical study was carefully examined by him with reference to the needs of his University, and of sound learning in general.

His visits to St. Louis, to consult with the venerable founder of the Shaw School of Botany in regard to the establishment, attest the fact that his interests in education were not local in their character. The wisdom with which that great enterprise was planned shows how far-reaching was his good judgment. It may with truth be said, that the Shaw School of Botany is at once a memorial of Henry Shaw, and of his friends George Engelmann and Asa Gray. It may well be numbered among Professor Gray's most enduring distinctions, that he assisted in shaping the future of two working schools of Botany.

Besides his educational works, his critical reviews have exerted a profound influence on the direction and scope of botanical education in this country. These reviews were judicial and impartial, — discriminating rather than laudatory. His censure was given in a kindly spirit, frequently with a light touch of humor, which was never suggestive of cynicism. He could find faults, but not as a fault-finder; his aim was always to secure improvement. When, as in one memorable instance, the errors pointed out by him were perpetuated in a second edition, he could bring to bear a severity of criticism which was promptly remedial. His command over written speech, by which sometimes words long unused by others were brought out of the armory for a single thrust, make many of his reviews instructive studies in style.

If the present speaker were to refer to Dr. Gray's contributions to education in general, instead of his influence on botanical education in particular, it would be necessary to bring to your notice also his treatment of Darwinism, and his popular expositions of scientific subjects. Of the effect which these have had in shaping educational methods in this country, in stimulating interest in natural history, and in promoting research, others will perhaps speak.

And others must allude to the incalculable influence of his dignified simplicity and noble character. But you will permit me, in closing these remarks, to emphasize that Professor Gray was directly and indirectly a teacher. Whoever examines the subject carefully will find that Harvard University and this Academy account among the highest services of the three naturalists whom we associate together their direct and indirect influence as teachers, — Louis Agassiz, Jeffries Wyman, and Asa Gray.

Professor Goodale was followed by Mr. Sereno Watson, the Curator of the Herbarium which Dr. Gray founded:

It is an interesting coincidence that the life of Asa Gray was closely parallel in this century to that of Linnæus in the last, — the one born in 1707, and dying in January, 1788; the other born in 1810, and dying in January, 1888. Linnæus was easily the master of all that was known in his day through the entire round of the natural sciences. Now, the ablest man finds ample scope for all his energies in any single branch of science. It is no longer derogatory to a man's fame that the field of his work has been circumscribed; it is rather a necessary condition to success.

The life-work of Asa Gray was thus in a great measure limited; and it is as a systematic botanist that he stands forth as especially eminent. The qualities of his mind fitted him remarkably for success in this department, — his accuracy of observation, not only seeing but knowing what it was that he saw, his power of recognizing the resemblances and affinities of plants as well as their differences, his clear judgment of the weight to be given to characters in any given case, and not least his wonderful memory, by virtue of which a plant once examined was never forgotten, and anything once read or heard was ever at command. His keen eye, his sound, quick, and critical judgment, his own confidence in that judgment, and his power of expressing his opinions in clear and concise language, gave him that weight of authority which has been acknowledged by all contemporary botanists.

Mr. Bentham, than whom there could be no one more competent to express a just opinion, said of him in 1866: —

> "No botanists in America are more actively at work than Asa Gray, whose well known accuracy of detail, connected with great correctness of general views, a thorough knowledge of general botany in all its branches, and a philosophical mind, has given him so high a rank among the votaries of the science."

And again in 1873: —

> "Of all the modern contributions to the study of Compositæ none are more important for the accuracy of observation and the due appreciation of characters and affinities than those of Asa Gray. His views may always be implicitly followed without any danger of being led into error, although sometimes a difference of opinion may exist upon such minor points as the generic or subgeneric value to be given to a group."

It was the study of the flora of North America to which he devoted these abilities, — the critical mastery of its orders, genera, and species in their relations to each other as forming one great flora, and as related more or less closely to the floras of other regions and other times. Everything that was done by him had a more or less direct reference to this main object, or was subordinate to it, whether it was giving instruction to his classes, preparing text-books and manuals, or writing articles and notices for the journals. It may even be said that it was only incidentally that he became a participant in the discussions on Darwinism, for which his previous study of species had eminently fitted him.

His early botanical work was done under difficulties. The prime requisites to the work of any systematic botanist are an herbarium and a library. Of these there were then none worthy the name in America. The best to be found were those belonging to the Academy of Natural Sciences at Philadelphia, and what Dr. Torrey had gathered about him in New York, and it was here that Dr. Gray made all his early researches. But type specimens of species for comparison were almost wholly wanting, as none of the collections which contained them were in this country. The collections of Clayton, Kalm, and Catesby; of Walter, Bartram, and Michaux; of Bradbury and Pursh, and even of our own Government explorers, Lewis and Clark; of Menzies and Douglas, and of all the arctic explorers, — upon which collections a very large part of the species then known had been founded, — were scattered through different European herbaria. Many of these were consulted by Dr. Gray on his first visit to Europe, and this fact gave to the published volumes of Torrey and Gray's Flora their great value.

With his settlement in Cambridge began in earnest an endeavor to gather together the herbarium and library that were absolutely necessary to the continuation of his work. He had already plants which he had himself collected in New York, New Jersey, and the Alleghanies, specimens received from many correspondents throughout the country, and some very valuable contributions from European botanists with whom he was now in intimate and most friendly relationship. In the preface to the early Flora acknowledgments are made of such gifts of plants, illustrative of the American flora, from Sir William Hooker, Dr. Richardson, Bentham, Lindley, Arnott, Spach, the elder De Candolle, Schlechtendal, Trinius, Bongard, and Lehmann. By a continuance of similar liberality on the part of both foreign and home friends, and by purchase from his own limited means (it is impossible now to say in what relative proportions), both herbarium and library gradually grew year by year, until after twenty-two years the house which he occupied became too strait to hold the accumulations. The whole, books and plants together, were then presented to Harvard University, in the building which had been erected for them by Nathaniel Thayer, and a small fund was raised by private subscription affording an income barely sufficing for the most necessary expenses of their care.

Twenty-four years more have passed, and herbarium and library have more than doubled in extent. Cases for plants have been added once and again, and a large room has been built for the library, in which the shelf-room is already too small. These later accretions have also been for the greater part the gift of Dr. Gray. Through his membership in numerous foreign societies, his position as botanical editor of the Journal of Science, and especially his eminence as the great botanist of America, whose acceptance and approval of a work were an honor, many more additions have been made to the library than by purchase with the small amount of money that could be spared for that purpose. And thus the library has grown to be by far the best working botanical library in the United States, though not indeed complete, nor what it needs to be. In like manner the herbarium has from many sources become very general in its character, and there is scarcely an accessible region on the globe whose flora is not to some extent, and often very largely, represented in it, and the number of known genera of phenogamous plants of which it does not possess specimens is remarkably small. This has been due mainly to Dr. Gray's wide acquaintance with the botanists of the world, and especially to the close intimacy that has always existed between him and the directors of the Royal Gardens at Kew, Sir William J. Hooker, Sir Joseph D. Hooker, and the present director, Mr. W. T. Thistleton Dyer, and to their generous sharing of the wealth of specimens continually coming in to them from all parts of the British Empire and from elsewhere, and to his like friendly relations with Russian botanists, from whom have come large collections from Central and Eastern Asia. But it is in the richness of its American collections that the great value of the Gray Herbarium to the American botanist lies. In the possession of typical specimens it stands unrivalled, including as it does the fullest sets of the collections of Fendler, Lindheimer, Wright, Hall, Parry, Bolander, Brewer, Palmer, Pringle, and others, the basis of many of Dr. Gray's classical papers, and procured often by a costly outlay of time and labor in their determination. It has also large sets of the collections made upon the Government Pacific Railroad Surveys, the Mexican Boundary Survey, and Geological Surveys, and very many specimens from collectors in British America and the Canadian Government Surveys, and from Greenland, Arctic America, and Alaska from various sources. It is enriched, moreover, with his determinations and notes, and with his memoranda upon the types of early species and the specimens of early collectors which have been examined by himself at various times in the herbaria at Kew, London, Paris, Madrid, Geneva, Berlin, Munich, Vienna, and elsewhere. In short, the Herbarium has become what Dr. Gray endeavored to make it, a mass of material fit to form the basis for a Flora of North America.

That Flora he labored upon for years, but left incomplete. *Finis coronat opus.* The crown of a finished life-work it was not permitted him to wear. But his monument is the Gray Herbarium, that makes completion still possible. The care of this Herbarium and its Library Harvard University has assumed; and Harvard University may be trusted, in honor of the man who has been its high honor, to maintain their integrity and pre-eminence, and to perpetuate, so far as possible, that high grade of botanical work and research of which they have hitherto been the main centre in America, and for which alone they have been created.

The resolutions were adopted by a unanimous vote.

Professor William G. Farlow then read a biographical notice of Dr. Gray, which had been prepared at the request of the Council, and is printed with the Report of the Council in Vol. XXIII. of these Proceedings.

The following papers were presented by title: —

On Sodic Zincates. By C. Loring Jackson and Arthur M. Comey.

Action of Sodium Malonic Ester on Tribromdinitrobenzol. By C. Loring Jackson and W. S. Robinson.

Contributions from the Physical Laboratory of Harvard University: 1. Limits of the Ultra Violet Spectra of Metals. By John Trowbridge and W. C. Sabine. 2. Photography of the Infra Red Spectra. By John Trowbridge and J. C. B. Burbank. 3. On a new Method of Measuring the Efficiency of Electrical Transformers. By John Trowbridge. 4. Experiments on the Electromagnetic Theory of Light. By John Trowbridge.

Eight hundred and fifteenth Meeting.

October 10, 1888. — STATED MEETING.

The PRESIDENT in the chair.

The President announced the death of Rudolph Julius Emmanuel Clausius, Foreign Honorary Member, and of Samuel Kneeland, Resident Fellow.

The Corresponding Secretary read a letter from the Secretary of the Franklin Institute, announcing that the Institute is empowered to award certain medals for meritorious discoveries and inventions which tend to the progress of the arts and sciences.

The following gentlemen were elected members of the Academy: —

John William Strutt, Lord Rayleigh, of Witham, to be a Foreign Honorary Member in Class I., Section 3, in place of the late Balfour Stewart.

Friherre Adolf Erik Nordenskiöld, of Stockholm, to be a Foreign Honorary Member, in Class II., Section 1, in place of the late Bernhard Studer.

Carl Johann Maximowicz, of St. Petersburg, to be a Foreign Honorary Member in Class II., Section 2, in place of the late August Wilhelm Eichler.

Henry Sidgwick, of Cambridge, to be a Foreign Honorary Member in Class III., Section 1, in place of the late Sir Henry James Sumner Maine.

John Evans, of Hemel Hempstead, to be a Foreign Honorary Member in Class III., Section 2, in place of the late Hugh Andrew Johnstone Munro.

Johann Wilhelm Adolf Kirchhoff, of Berlin, to be a Foreign Honorary Member in Class III., Section 2, in place of the late Georg Curtius.

Charles Jacques Victor Albert, Duc de Broglie, of Paris, to be a Foreign Honorary Member in Class III., Section 3, in place of the late Leopold von Ranke.

Leslie Stephen, of London, to be a Foreign Honorary Member in Class III., Section 4, in place of the late Matthew Arnold.

George Brown Goode, of Washington, to be an Associate Fellow in Class II., Section 3, in place of the late Spencer Fullerton Baird.

On the recommendation of the Rumford Committee, it was

Voted, That an appropriation of five hundred dollars ($500) be made from the income of the Rumford Fund to assist Professor Trowbridge in his work on the metallic spectra.

Voted, That an appropriation of five hundred dollars ($500) be made from the income of the Rumford Fund to enable Mr. W. H. Pickering to observe the solar corona during the eclipse of January 1, 1889, which is visible in California.

On the motion of the Corresponding Secretary, it was

Voted, To meet, on adjournment, on the second Wednesday in November.

The following papers were read: —

Atmospheric Economy of Solar Radiation. By Arthur Searle.

Further Study of the Structure of Iron Meteorites. By Oliver W. Huntington.

Some Defects in Physical Terminology. By Amos E. Dolbear.

The following papers were presented by title: —

Studies from the Newport Marine Laboratory, communicated by Alexander Agassiz. A Preliminary Account of the Development and Histology of the Eyes in the Lobster. By G. H. Parker.

List of Plants collected by Dr. Edward Palmer, in 1887, at Guaymas, Sonora, and at Los Angeles Bay and adjacent Localities in Lower California. By Sereno Watson.

Eight hundred and sixteenth Meeting.

November 14, 1888. — ADJOURNED STATED MEETING.

The PRESIDENT in the chair.

Letters were read from John Evans and Henry Sidgwick, acknowledging their election as Foreign Honorary Members; also, a letter from George Brown Goode, acknowledging his election as Associate Fellow.

The following papers were presented: —

A New Galvanic Cell. By Amos E. Dolbear.

The Strength of the Microphone Current as influenced by Variations in Normal Pressure and Mass of the Electrodes. By Annie W. Sabine.

Researches on Microphone Currents. By Charles R. Cross and Annie W. Sabine.

The Strength of the Current of the Magneto Telephone as influenced by Variations in the Strength of the Magnet. By Charles R. Cross and Arthur S. Williams.

Eight hundred and seventeenth Meeting.

December 12, 1888. — MONTHLY MEETING.

The PRESIDENT in the chair.

Dr. Charles S. Minot presented a paper entitled "Researches on the Problem of Growth and Death."

Eight hundred and eighteenth Meeting.

January 9, 1889. — STATED MEETING.

In the absence of the President, Dr. Henry W. Williams took the chair.

The Corresponding Secretary read letters from the Duc de Broglie, A. Kirchhoff, A. E. Nordenskiöld, and Lord Rayleigh, acknowledging their election as Foreign Honorary Members; from the Royal Bohemian Society of Sciences, announcing the death of its president, Josef Jireček; and from Mr. W. W. Story, the Delegate of the Academy appointed to attend the celebration of the eight hundredth anniversary of the University of Bologna.

PROFESSOR JOSEPH LOVERING: —

Dear Sir, — I have to apologize for having so long delayed to report to you, as President of the Academy of Arts and Sciences, the proceedings and ceremonies which took place at Bologna on the celebration of the eight hundredth anniversary of its famous University; but I rely on your kindness to find an excuse for me, without my going into the reasons for my delay.

In conformity with the mandate of the Academy, I proceeded to Bologna on the 10th of June, and there was received most kindly by the Rector and the Syndic, who furnished me with a most pleasant apartment in a private house, where your representative had no possible cause of complaint, but, on the contrary, everything to be grateful for personally. I make this statement because I have heard that much complaint was made by others on the manner of their accommodation, and this naturally grew out of the fact of the numerous concourse of representatives from every quarter of the world, and of the confusion naturally incident to such a state of things.

On the 11th, at nine in the morning, there was a formal presentation of all the delegates from the various universities, academies, and scientific institutes to the Syndic. At noon the inauguration of the equestrian monument to Victor Emanuel took place, at which all the various delegates were present. At half-past eight in the evening there was an artistic torchlight procession in honor of the King and Queen, which was eminently imposing and picturesque.

On the 12th, all the professors and delegates met at the University at nine o'clock, and there formed in procession, proceeding through the main street of the city to the building of the Archiginnasio. Nothing could be more picturesque and interesting than this procession. By special request of the authorities, the greater portion of the delegates were dressed in their academical and official robes, the effect of which was most striking. Every variety of costume was there to be seen, from all the quarters of the world. Mr. James Russell Lowell and myself appeared in Oxford gowns as Doctors of Law. The streets through which we passed were thronged with a dense crowd. Every window and balcony was filled, and as the procession passed along each delegation was saluted with hearty cheers, while from the windows and balconies showers of roses and bay and laurel leaves were rained upon it. The great Cortile of the Archiginnasio, which is a noble old structure, was covered with a striped awning of blue and red. The upper porticos were thronged by invited guests, the intermediary columns and arches being decorated with wreaths and flowers, while the floor was occupied by the students and professors of the University and the delegates. In the central arch, facing the entrance, a lofty canopy was erected, with a dais on which were seated the King, Queen, and Prince Royal, attended by the officials of the court, all in uniform and court dress. When the company had assembled, a Cantica, the words of which were composed by Professor Panzacchi and set to music by Baron Alberto Franchetti, was sung by a grand chorus, and after this Professor Giosue Carducci, the distinguished writer and poet, delivered an interesting discourse, the subject of which was "Lo Studio Bolognese."

On the same day, at six P. M., all the representatives of the various foreign universities and academies were invited to a great banquet given by the government of His Majesty, the King of Italy, which was largely attended, all present being in full dress, with their decorations, by particular request.

On the 13th, all the delegates were again brought together in the Cortile of the Archiginnasio, all in their academic or official robes and with their decorations. The scene was similar to that of the previous day, and equally imposing. On this occasion degrees of honor were conferred by the Rector, one being given to each delegation. The degree conferred on the American delegation was given to Mr. Lowell, in accordance with the general wish of all the representatives from America.

As each degree was given by the Rector, the whole delegation of which the recipient of the honor was a member was called, and accompanied him to the foot of the canopy under which the royal family was seated. The Rector then made a short address, placed on his finger the large ring of the University, and then, withdrawing it, presented him with his diploma. To this the Laureate replied in an address, either in Latin or Italian, to the King and Queen, as well as to the Rector and Professors.

In accordance with the request of the American Legation, the duty of making this address in their behalf and that of the Laureate was performed by me in Italian, and I am happy to say that it was well received by the royal family, as well as the Rector and Professors and the audience in general, so that I hope I did not do discredit to the distinguished Academy which I had the honor to represent.

All the delegates were furnished with tickets to the Exhibition, which was extremely interesting, and to the various concerts and ceremonies and entertainments given by the authorities. Among these I have omitted to speak of the interesting discourse by Professor Enrico Panzacchi, to which we were all invited by a committee of the students.

A grand reception was also given by the King and Queen at the Palace of the Prefettura, at which all the delegates were personally presented to their Majesties and received with the greatest courtesy and kindness.

The ceremonies and receptions having come to an end on the evening of the 13th, I left Bologna, and have nothing further to report.

With high regard, I have the honor to be

Yours most faithfully,

W. W. STORY.

LONDON, July 10, 1888.

On the motion of the Corresponding Secretary it was

Voted, To meet, on adjournment, on the second Wednesday in February.

The following paper was read: —

Comparison of Right Ascensions of Polar Stars in Recent Catalogues. By Truman H. Safford.

The following papers were presented by title: —

Determination of Chromium in Chrome Iron Ore. By Leonard P. Kinnicutt and George W. Patterson.

Measurements of Specific Inductive Capacity. By William W. Jacques.

Eight hundred and nineteenth Meeting.

February 13, 1889. — ADJOURNED STATED MEETING.

The PRESIDENT in the chair.

The President announced the death of John Call Dalton, of New York, Associate Fellow.

The Corresponding Secretary read letters from the New York Academy of Sciences, requesting aid in erecting a monument to Audubon; from the United States Commissioner to the Paris Exhibition, requesting information in reference to the library of the Academy; and from the Royal Academy of Sciences of Turin, announcing the conditions of competition for the seventh Bressa Prize.

The following papers were presented: —

The Application of the Stroboscopic Method to the Study of the Excursion of the Electrode of a Microphone Transmitter. By Charles R. Cross.

On the Rotation resulting from the Vibration of a Chladni Plate. By Amos E. Dolbear.

On Pentamidobenzol. By C. Loring Jackson and A. W. Palmer.

On Reversible Chemical Reactions. By P. C. Freer.

Eight hundred and twentieth Meeting.

March 13, 1889. — STATED MEETING.

The PRESIDENT in the chair.

The following gentlemen were elected members of the Academy: —

Cecil Hobart Peabody, of Boston, to be a Resident Fellow in Class I., Section 4.

Peter Schwamb, of Boston, to be a Resident Fellow in Class I., Section 4.

Henry Willey, of New Bedford, to be a Resident Fellow in Class II., Section 2.

Harold Clarence Ernst, of Boston, to be a Resident Fellow in Class II., Section 3.

Samuel Henshaw, of Cambridge, to be a Resident Fellow in Class II., Section 3.

Edward Hickling Bradford, of Boston, to be a Resident Fellow in Class II., Section 4.

Arthur Tracy Cabot, of Boston, to be a Resident Fellow in Class II., Section 4.

David Williams Cheever, of Boston, to be a Resident Fellow in Class II., Section 4.

Reginald Heber Fitz, of Boston, to be a Resident Fellow in Class II., Section 4.

John Homans, of Boston, to be a Resident Fellow in Class II., Section 4.

Frederick Irving Knight, of Boston, to be a Resident Fellow in Class II., Section 4.

George Hinckley Lyman, of Boston, to be a Resident Fellow in Class II., Section 4.

Henry Pickering Walcott, of Cambridge, to be a Resident Fellow in Class II., Section 4.

Franklin Carter, of Williamstown, to be a Resident Fellow in Class III., Section 2.

Franklin Bache Stephenson, of Boston to be a Resident Fellow in Class III., Section 2.

Frank William Taussig, of Cambridge, to be a Resident Fellow in Class III., Section 3.

Barrett Wendell, of Boston, to be a Resident Fellow in Class III., Section 4.

John Nelson Stockwell, of Cleveland, Ohio, to be an Associate Fellow in Class I., Section 1, in place of the late Ezekiel Brown Elliott.

Alexander Johnston, of Princeton, New Jersey, to be an Associate Fellow in Class III., Section 3, in place of the late Samuel Gilman Brown.

Dmitri Ivanowitsh Mendeleeff, of St. Petersburg, to be a Foreign Honorary Member in Class I., Section 3.

Wilhelm Edward Weber, of Göttingen, to be a Foreign Honorary Member in Class I., Section 3, in place of the late Gustav Robert Kirchhoff.

Anatole François Hüe, Marquis de Caligny, of Versailles, to be a Foreign Honorary Member in Class I., Section 4, in place of the late Rudolph Julius Emmanuel Clausius.

The Rumford Committee, through its chairman, Professor Lovering, submitted the following report: —

The Rumford Committee recommend to the Academy an appropriation of $100 to Professor E. Hall to enable him to make certain investigations as to the fluctuations of temperature which occur at the inner surface of the cylinder of a steam-engine in operation.

They also recommend an appropriation of $250 from the same fund to Professor C. C. Hutchins, of Bowdoin College, for the purchase of a large parabolic mirror of glass and its mounting to be used for the completion of his investigation on Lunar Radiation.

The report of the committee was adopted, and the appropriations voted.

The following papers were read: —

Experimental Proof of Newton's Law of Cooling as applied to Thermometers and to Rectangular Bars of Metal. By William A. Rogers.

Experimental Proof that the Relative Coefficient of Expansion between Brass and Steel is Constant between the Limits of —5° Fahr. and +100° Fahr. By William A. Rogers.

Professor Charles R. Cross read a paper entitled "On the Relation of the Candle-Power of Incandescent Electric Lamps to Current, Potential Difference, and Energy consumed in them." By L. A. Ferguson and D. A. Center.

Professor Benjamin O. Peirce presented the following papers by title: —

On Lunar Radiation. By C. C. Hutchins.

On the Charging of Condensers by Galvanic Batteries. By B. O. Peirce and R. W. Wilson.

Eight hundred and twenty-first Meeting.

April 10, 1889. — MONTHLY MEETING.

THE PRESIDENT in the chair.

Letters were read from Messrs. Bradford, Cheever, Ernst, Fitz, Knight, Lyman, Peabody, Schwamb, Stephenson, and Wendell, accepting Fellowship in the Academy; also, from Messrs. Johnston and Stockwell, acknowledging their election as Associate Fellows.

The President, having stated that the special business of the meeting was the presentation of the Rumford Medals, made the address printed among the papers of this volume, on the numerous investigations which had been made on the velocity of light, and their relation to the theories of optics and delicate questions in astronomy. He then addressed Professor Michelson in these words: —

PROFESSOR MICHELSON, — It is now my duty and privilege to present to you, in the name of the Academy and in the presence of these members, here assembled to administer Count Rumford's Trust, the gold and silver medals which together constitute the Rumford Premium. Be pleased to receive with these medals my congratulations, and those of all the other members of the Academy, for the intelligence, ingenuity, and perseverance with which you have labored towards the solution of problems of the greatest concern to more than one of the physical sciences.

Professor Michelson, having received the medals, made the following reply: —

MR. PRESIDENT AND GENTLEMEN OF THE ACADEMY, — I wish to thank you sincerely, and to express my appreciation of the high honor you have just conferred upon me. These medals I shall always regard as a token of your encouragement and approval; but in addition they will, I trust, be a strong incentive for the future to do the best that is in me to justify this expression of your kind appreciation.

The following paper was presented by title: —

Classification of the Atomic Weights in two Ascending Series, corresponding to the Groups of Artiads and Perissads. By W. R. Livermore.

Eight hundred and twenty-second Meeting.

May 8, 1889. — MONTHLY MEETING.

THE PRESIDENT in the chair.

The President announced the death of Jonathan Ingersoll Bowditch, senior Resident Fellow, elected on November 12, 1834, who died on February 19, 1889. He served as Treasurer from 1842 to 1852, and was a member of the Council from 1854 to 1856, and from 1858 to 1863.

WRITERS OF NOTICES IN REPORT OF THE COUNCIL.

GEORGE RUMFORD BALDWIN, by Rev. George E. Ellis.
JONATHAN INGERSOLL BOWDITCH, by Rev. A. P. Peabody.
SAMUEL KNEELAND, by Prof. J. D. Runkle.
E. B. ELLIOTT, by Gen. F. A. Walker.
F. A. P. BARNARD, by Prof. J. Lovering.
JOHN C. DALTON, by Dr. H. P. Walcott.
M. E. CHEVREUL, by Prof. F. H. Storer.
R. J. E. CLAUSIUS, by Prof. J. Willard Gibbs.
F. C. DONDERS, by Dr. H. W. Williams.